

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY  
(SUPPLEMENTARY SHEET)

International File No. PCT/DE2004/002179

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1. Reference is made to the following documents in the present opinion:

D1: US 5,866,799  
D2: EP 1 167 957 A2  
D3: WO 02/090957 A2  
D4: DE 100 13 882 A1 (cited in the application)

Point V:

2. The present application does not fulfill the requirements of Article 33(1) PCT because, as far as can be understood at all (see paragraph 4 below), the object of Claims 1 through 12 is not novel as defined by Article 33(2) PCT and/or is not based on an inventive step (Article 33(3) PCT).

- 2.1. Document **D1** discloses (the references in parentheses relate to this document): a sensor element (see Figure 12 and associated description in particular), in particular for the detection of a physical property of a measuring gas, preferably for determining the partial pressure of a component in an exhaust gas of an internal combustion engine (column 1, lines 11 through 17), having at least one electrochemical measuring cell (column 12, lines 46 through 53), which comprises a first electrode 24 (column 12, line 43) and a second electrode 28 (column 12, line 33), which are electrically connected by a solid electrolyte 4c (column 12, lines 47 through 49), the second electrode 28 being situated in a gas chamber 8 (column 12, lines 33 through 36), which is connected to

the measuring gas located outside the sensor element via a first element 38 having a catalytically active material (column 19, lines 27 through 29) and a second diffusion-limiting element 14 (column 11, lines 46 through 47). The first element 38 has a length of at least 1 mm in the diffusion direction of the measuring gas (this may be seen clearly from a comparison of Figure 12 and/or 11 with the statements in column 16, lines 31 through 32, 42 through 44).

Accordingly, all features of **Claim 1** are disclosed in context in **D1** (Article 33(2) PCT).

- 2.2. Document **D2** discloses (the references in parentheses relate to this document): a sensor element (see Figure 1 and associated description in particular), in particular for detecting a physical property of a measuring gas, preferably for determining the partial pressure of a component in an exhaust gas of an internal combustion engine (§1), having at least one electrochemical measuring cell (§12), which comprises a first electrode 15 (§12) and a second electrode 14 (§12), which are electrically connected by a solid electrolyte 1b (§12), the second electrode 14 being situated in a gas chamber 3 (§12), which is connected to the measuring gas located outside the sensor element via a first element 25 having a catalytically active material (§14, 19, 21 through 25) and a second diffusion-limiting element 6 (§14). In this case, the first element 25 has a length of at least 1 mm in the diffusion direction of the measuring gas (this statement is not explicitly contained in D2, but the element 25 should typically have this dimension through comparison with the other elements illustrated in Figure 1).

Accordingly, all features of **Claim 1** seem to be (implicitly) disclosed in **D2** in the context (Article 33(2) PCT).

At least the object of **Claim 1**, based on **D2**, is not based on an inventive step (Article 33(3) PCT).

- 2.3. Document **D3** discloses (the references in parentheses relate to this document): a sensor element (see Figures 1, 2 and associated description in particular), in particular for detecting a physical property of a measuring gas, preferably for determining the oxygen partial pressure in an exhaust gas of an internal combustion engine (page 1, lines 14 through 16, page 5, lines 27 through 29), having at least one electrochemical measuring cell (page 6, line 16 through 18), which comprises a first electrode 33 (page 6, line 16) and a second electrode 31 (page 6, line 14), which are electrically connected by a solid electrolyte 21 (page 6, lines 13 through 18), the second electrode 31 being situated in a gas chamber 41 (page 6, lines 13 through 14), which is connected to the measuring gas located outside the sensor element via a first element 50 having a catalytically active material (page 6, lines 32 through 33, page 8, lines 12 through 14) and a second diffusion-limiting element 44 (page 5, line 36). The first element 50 has a length of at least 1 mm in the diffusion direction of the measuring gas in this case (this statement is not explicitly contained in **D3**, but element 50 should typically have this dimension through comparison with the other elements illustrated in Figure 2).

Accordingly, all features of **Claim 1** seem to be (implicitly) disclosed in **D3** in the context (Article 33(2) PCT).

At least the object of **Claim 1**, based on D3, is not based on an inventive step (Article 33(3) PCT).

- 2.4. Document **D4** discloses (the references in parentheses relate to this document): a sensor element (see Figures 1, 2 and associated description in particular), in particular for detecting a physical property of a measuring gas, preferably for determining the oxygen partial pressure in an exhaust gas of an internal combustion engine (§2, lines 1 through 3, 8), having at least one electrochemical measuring cell (§12), which comprises a first electrode 20 (§12) and a second electrode 22 (§12), which are electrically connected by a solid electrolyte 11a (§12), the second electrode 22 being situated in a gas chamber 13 (§12), which is connected to the measuring gas located outside the sensor element via a first element 14, 14a having a catalytically active material (§19, §22) and a second diffusion-limiting element 12 (16).

The object of **Claim 1** of the present application differs from the sensor element of D4 only in that the first element has a length of at least 1 mm in the diffusion direction of the measuring gas.

However, no inventive step may be attributed to this feature (Article 33(3) PCT), since D4 itself clearly indicates (§7: "... rather fills up the entire area between gas intake opening and diffusion barrier with a coarse-pored and catalytically active material..."; §19: " the layer thickness is, however, not to fall below a specific minimum in order to allow intensive contact of the gas mixture with the catalytically active surface of the coarse-pored area"; §22: "Setting the gas components in catalytic equilibrium with one another is ensured by the path length of the penetrating gases thus extended

within the coarse-pored catalytically active area 14a.") that element 14, 14a meant for complete conversion of interfering gas components requires a specific minimum dimension in the direction of the gas diffusion.

- 2.5. **Claims 2 through 12** do not contain any features which fulfill the requirements of the PCT in regard to novelty and/or inventive step in combination with the features of any claim to which they refer, since their additional features are already disclosed in Documents D1-D4 (see the citations provided in the International Search Report) or only relate to an obvious selection of parameters without inventive activity.

**Point VII:**

3. For reasons of completeness, the following formal defects are also noted:
- (i) Independent **Claim 1** is not correctly worded in the two-part form (Rule 6.3(b) PCT), see paragraph 2 above.
  - (ii) Most of the dependent claims do not fulfill the requirements of Rule 6.4(a) PCT (third sentence).
  - (iii) Contrary to the requirements of Rule 5.1(a)(ii) PCT, neither the relevant related art disclosed in Documents D1-D3 nor these documents are cited in the description.
  - (iv) Document D4 is not correctly summarized in the description; in the embodiment of Figure 2, the catalytically active area 14a is not a "thin layer."

**Point VIII:**

4. The application does not fulfill the requirements of Article 6 PCT, because some of the claims are not clear.

- 4.1. The feature in **Claim 1** "gas chamber..., which is connected to the... measuring gas via an element having a catalytically active material and a second... element" is unclear and leaves the reader uncertain about the meaning of the relevant technical feature(s). This results in the definition of the object of this claim not being clear. In particular, it is not clear what is to be understood under the vague feature "an element having a catalytically active material." Is it to allow gas exchange at all? This is also not explained by the formulation "is connected." Notwithstanding this, the arrangement of the two "elements" to one another is not clear (see Claim 8 in this regard, for example).
- 4.2. Furthermore, the feature in **Claim 1** "the first element has a length of... in the diffusion direction of the measuring gas" is undetermined. Such a diffusion direction was not defined in the preceding statements.
- 4.3. Multiple features were not appropriately defined in the preceding statements. The relevant claims thus appear unclear. Specifically, these are the features "the proportion of voids in the first/second element" (**Claim 4**), "the volume of the first element filled with a porous material" (**Claim 5**), "the diffusion cross section of the first/second element" (**Claim 6**), "the height/width of the first element" (**Claim 7**), "the diffusion cross section of the first element" (**Claim 9**), "the largest cross section of the constriction" (**Claim 11**), "the layer plane of the measuring gas chamber," and "the measuring gas chamber" (**Claim 12**).
- 4.4. Furthermore, it is not clear in **Claims 5 and/or 7** whether the "porous material" cited is to be the "catalytically active material" already defined in Claim 1, or another

additional (perhaps even alternative) material in each case.

4.5. The term "diffusion cross section" used in **Claim 6** (among other places) does not have a generally recognized meaning for one skilled in the art and leaves the reader uncertain about the meaning of the relevant technical feature(s). The intended scope of protection of this claim thus appears unclear.

4.6. The feature in **Claim 11** "whose mean pore diameters..." does not appear to make sense. Are there multiple mean pore diameters?